CLAIMS

1. A method of plating a pattern of material on a nonplanar surface of an article, comprising:

contacting a first, nonplanar portion of a surface of an article with a stamp to transfer to the first portion a self-assembled monolayer of a molecular species in a first pattern, the self-assembled monolayer being contiguous with an exposed portion of the surface in a second pattern; and

plating the surface of the article with a plating reagent in a pattern dictated by the pattern of the self-assembled monolayer.

2. A method as in claim 1, wherein the article is a fiber.

3. A device comprising:

an article defining a surface; and

an isolated region of a self-assembled monolayer of a first molecular species on the surface, the isolated region including a lateral dimension of less than about 10 microns, surrounded by a continuous region of a self-assembled monolayer of a second molecular species on the surface, wherein the first molecular species terminates in an end exposed away from the surface having a first functionality and the second molecular species terminates in an end facing away from the surface having a second functionality.

4. A device as in claim 3, wherein the isolated region of the first molecular species has a lateral dimension of less than about 5 microns.

5. A device as in claim 3, wherein the isolated region of the first molecular species has a lateral dimension of less than about 1 micron.

6. A device as in claim 3, wherein the isolated region of the first molecular species has a lateral dimension of less than about 0.25 micron.

7. A device as in claim 3, wherein the isolated region of the first molecular species has an area of less than about 100 square microns.

8. A device as in claim 3, wherein the isolated region of the first molecular species has an area of less than about 25 microns.

9. A device as in claim 3, wherein the isolated region of the first molecular species has an area of less than about 1 square micron.

10. A device as in claim 3, wherein the isolated region of the first molecular species has an area of less than about 0.06 square micron.

11. A device as in claim 3, wherein the surface is nonplanar.

12. A device as in claim 3, wherein the first molecular species terminates in an end facing away from the surface having a hydrophilic functionality and the second molecular species terminates in an end facing away from the surface having a hydrophobic functionality.

13. A device as in claim 3, wherein the first molecular species terminates in an end facing away from the surface in a hydrophobic functionality and the second molecular species terminates in an end facing away from surface in a hydrophilic functionality.

14. A device as in claim 13 wherein the surface is nonplanar.

15. A device as in claim 12 wherein the surface is nonplanar.

16. A kit, comprising:

an article constructed and arranged to transfer a molecular species to a substrate surface, comprising an applicator surface having at least one indentation formed therein and a stamping surface adjacent the at least one indentation, for carrying a self-assembled monolayer-forming molecular species and able to transfer the molecular species to the substrate, the stamping surface formed of a swellable material which absorbs the molecular

species; and

a self-assembled monolayer-forming molecular species for application by the stamping surface.

17. The kit as recited in claim 16, the stamping surface comprising at least one resolved feature providing stamping resolution of less than about 100 microns.

18. The kit as recited in claim 17, the stamping surface comprising at least one resolved feature providing stamping resolution of less than about 10 microns.

19. The kit as recited in claim 18, the stamping surface comprising at least one resolved feature providing stamping resolution of less than about 1 micron.

20. The kit as recited in claim 19, the stamping surface comprising at least one resolved feature providing stamping resolution of less than about 0.25 micron.

21. The kit as recited in claim 16, the article formed from an elastic material.

22. The kit as recited in claim 21, the elastic material formed from a hardenable fluid.

23. The kit as recited in claim 21, the elastic material selected from the group consisting of silicone polymers and copolymers, epoxy polymers and copolymers, and copolymers thereof.

24. A kit, comprising:

an article for transferring a molecular species to a surface, comprising a flexible surface having at least one indentation formed therein and an applicator surface adjacent the at least one indentation for carrying a molecular species and transferring the molecular species to a substrate, the applicator surface including a portion having a lateral dimension of less than about 10 microns, wherein the flexible surface comprises polydimethyl siloxane; and

a self-assembled monolayer-forming molecular species for application by the applicator surface.

25. An optical fiber having a surface, and a self-assembled monolayer on the surface of the optical fiber.

26. A method comprising:

transferring to a surface of a fiber a molecular species from an applicator in a pattern including a portion having a lateral dimension of less than about 10 microns.

27. A method as in claim 26, wherein the pattern includes a portion having a lateral dimension of less than about 1 micron.

28. A method as in claim 26, wherein the pattern includes a portion having a lateral dimension of less than about 0.5 micron.

29. A method as in claim 26, wherein the fiber is an optical fiber.

30. A method as in claim 26, further comprising etching a portion of the surface of the fiber in a pattern dictated by the pattern of the molecular species.

31. A method as in claim 26, further comprising plating a portion of the surface of the fiber with a plating agent in a pattern dictated by the pattern of the molecular species.

32. An article comprising:

a flexible member having a flexible surface including at least one indentation formed therein, the at least one indentation formed such that electromagnetic radiation passing through the flexible member when the member is in a first, unstressed conformation forms a first detectable image and formed such that electromagnetic radiation passing through the flexible member when the member is in a second, stressed conformation forms a second detectable image differentiable from the first image; and

a modulator contacting the flexible member and movable between a first position placing the member in the first, unstressed conformation and a second position placing the member in the second, stressed conformation.

33. An article as in claim 32, further comprising:

a source of electromagnetic radiation positioned to irradiate the flexible member; and

an electromagnetic radiation detector positioned to detect radiation emitted by the eletromagnetic radiation source and passing through the flexible member.

34. An article as in claim 33, the flexible member having a flexible surface including a plurality of indentations formed therein, the indentations formed such that electromagnetic radiation passing through the surface when the member is in the first, unstressed conformation is diffracted according to an ordered diffraction pattern and formed such that electromagnetic radiation passing through the surface when the member is in the second, stressed conformation is blurred.

35. An article as in claim 34, wherein the source of electromagnetic radiation is positioned to irradiate the flexible member through the flexible surface.

36. An article as in claim 34, wherein the modulator includes a modulating surface positioned against the flexible surface and movable between the first and second positions.

37. An article as in claim 36, wherein the modulator includes a peizoelectric member.

38. An article as in claim 37, further comprising an electrical source in electrical communication with the peizoelectric member, the electrical source switchable between a first signal state in which the peizoelectric member is in the first position and a second signal state in which the peizoelectric member is in the second position.

39. An article as in claim 32, the article comprising a pressure sensor.

40. An article as in claim 32, the article comprising an optical switch.

41. A kit, comprising:

an article constructed and arranged to transfer a molecular species to a substrate surface comprising an applicator surface having at least one indentation formed therein and a stamping surface adjacent the at least one indentation, for carrying a self-assembled monolayer-forming molecular species and transferring the molecular species to the substrate, the stamping surface formed of a swellable material which absorbs the molecular species, wherein the stamping surface comprises polydimethyl siloxane; and

a self-assembled monolayer-forming molecular species for application by the stamping surface.

42. The kit as in claim 24, wherein the applicator surface includes a portion having a lateral dimension of less than about 1 micron.

43. A method comprising:

providing an applicator having a surface including at least one indentation formed therein, the indentation contiguous with an applicating surface defining a first pattern;

coating the applicating surface with a molecular species comprising a functional group selected to bind to palladium;

positioning the applicating surface in a first orientation and contacting a portion of a substrate surface comprising palladium with the applicating surface to hold the molecular species against the substrate surface to allow the functional group to bind thereto; and

removing the applicating surface to provide a self-assembled layer of the molecular species on the substrate surface according to the first pattern.

44. The method of claim 43, further comprising providing at least one second portion of the substrate surface free of the self-assembled layer and contiguous with the substrate surface portion onto which the self-assembled layer is provided.

45. The method of claim 44, wherein coating the applicator surface further comprises allowing the molecular species to swell into the applicator surface.

46. The method of claim 44, further comprising:

positioning the applicator surface in a second orientation different from the first orientation, and contacting a portion of the substrate surface with the applicator surface to hold the molecular species against the substrate surface to allow the functional group to bind thereto; and

removing the applicating surface to provide a self-assembled layer of the molecular species on the substrate surface according to the first pattern in the second orientation.

47. The method of claim 46, wherein the self-assembled layer of the molecular species on the substrate surface in the second orientation intersects portions of the self-assembled layer in the first orientation and forms a continuous self-assembled layer therewith.

48. A method for patterning a surface, comprising:

applying instantaneously to a surface comprising palladium a plurality of discrete isolated regions of a first, self-assembled layer forming molecular species while leaving intervening regions free of the species.

49. The method of claim 48, wherein the surface comprising palladium is non-planar.

50. The method of claim 49, wherein at least one of the discrete isolated regions includes a lateral dimension of less than 200 microns.

51. The method of claim 50, wherein at least one of the discrete isolated regions includes a lateral dimension of less than about 100 microns.

52. The method of claim 51, wherein at least one of the discrete isolated regions includes a lateral dimension of less than about 5 microns.

53. The method of claim 48, wherein the at least one of the discrete isolated regions has an area of less than 1 square micron.

54. The method of claim 53, wherein the at least one of the discrete isolated regions has an area of less than 0.06 square microns.

55. An article defining a surface comprising palladium; and

a self-assembled layer of molecular species on the surface defining a pattern, the pattern corresponding to a pattern of an applicating surface able to direct formation of the pattern of the monolayer of the molecular species on the surface.

56. The article of claim 55, wherein the pattern includes a lateral dimension of less than 10 microns.

57. The article of claim 56, wherein the pattern includes a lateral dimension of less than about 5 microns.

58. The article of claim 57, wherein the pattern includes a lateral dimension of less than about 1 micron.

59. The article of claim 58, wherein the pattern includes a lateral dimension of less than about 0.25 micron.

60. A method of etching an article having a surface comprising palladium, comprising:

contacting a first portion of the surface with an applicator to transfer to the first portion a self-assembled layer of a molecular species in a first pattern, the self-assembled layer being contiguous with an exposed portion of the surface in a second pattern; and

contacting the article with an etchant that reacts chemically with the article thereby degrading a portion of the article in a pattern dictated by the pattern of the self-assembled layer.

61. The method of claim 60, further comprising coating a surface of the applicator with a self-assembled layer forming molecular species prior to contacting a first portion of the surface with the applicator.

62. The method of claim 61, wherein the surface of the applicator includes indentations and protrusions, the outward-facing surfaces of which define an applicator surface, the contacting step involving contacting the firs, non-planar portion of the surface with the applicator surface.

63. The method of claim 62, the contacting step comprising transferring the self-assembled layer to the non-planar portion of the surface by rolling the firs, non-planar portion of the article over the applicating surface of the applicator.

64. The method of claim 60, wherein the etchant is a first etchant.

65. The method of claim 64, further comprising contacting the article with a second etchant.

66. The method of claim 64, wherein the self-assembled layer resists the first etchant.

67. The method of claim 61, comprising applying a protecting species to the self-assembled layer.

68. The method of claim 67, wherein the protecting species is inert with respect to the first etchant.

69. A device comprising:

an article defining a surface comprising palladium;

an isolated region of a self-assembled layer of a first molecular species on the surface, the isolated region including a lateral dimension of less than 200 microns.

70. The device of claim 69, wherein the isolated region includes a lateral dimension of less than about 110 microns, surrounded by a continuous region of a self-assembled layer of a second molecular species on the surface, wherein the first molecular species comprises a first functionality and the second molecular species comprises a second functionality.

71. The device of claim 70, wherein the isolated region of the first molecular species has a lateral dimension of less than about 10 microns.

72. The device of claim 71, wherein the isolated region of the first molecular species has a lateral dimension of less than about 5 microns.

73. The device of claim 72, wherein the isolated region of the first molecular species has a lateral dimension of less than about 1 micron.

74. The device of claim 69, wherein the isolated region of the first molecular species has an area of less than 1 square micron.

75. The device of claim 74, wherein the isolated region of the first molecular species has an area of less than 0.06 square micron.

76. A method of plating a pattern of material on a surface of an article comprising palladium, the method comprising:

contacting a first portion of a surface of an article with an applicator to transfer to the first portion a self-assembled layer of a molecular species in a first pattern, the self-assembled layer being contiguous with an exposed portion of the surface in a second pattern; and

plating the surface of the article with a plating reagent in a pattern dictated by the pattern of the self-assembled layer.

77. The method of claim 76, wherein the surface of the article is non-planar.

78. A device for adhering at least one biological species in a specific and predetermined pattern comprising:

a surface;

a plurality of immobilization islands in a specific and predetermined pattern over the surface that adhere biological species to the islands, the islands isolated from each other by a background region contiguous with the islands and to which the biological species do not adhere, and wherein the islands or the background region or both comprise a self-assembled monolayer.

79. The device of claim 78, wherein the biological species is a cell.

80. The device of claim 78, wherein the background region or the immobilization islands comprise more than one self-assembled monolayer.

81. A device for selectively adhering protein in a specific and predetermined pattern comprising:

a surface;

a plurality of immobilization islands in a specific and predetermined pattern over the surface that selectively adhere protein to the islands, the islands isolated from each other by a background region contiguous with the islands and to which the protein does not adhere.

82. A device having a surface, comprising:

islands of a self-assembled monolayer terminating in a non-polar functionality surrounded by regions of a polyethylene glycol-terminating self-assembled monolayer, wherein the nonpolar functionality of the islands is protein adherent, while the polyethylene glycol is not protein adherent.

83. A device for immobilizing at least one biological material in a specific and predetermined pattern comprising:

a surface;

an array of immobilization islands in a specific and predetermined pattern over the surface isolated from each other by at least one background region;

the array of immobilization islands comprising a first self-assembled monolayer having a formula $HS(CH_2)_nR$ in which R comprises at least one first functional group and wherein the at least one first functional group is selected to be biophilic;

the at least one background region comprising a second self-assembled monolayer having a formula $HS(CH_2)_nR$ in which R comprises a second functional group wherein the second functional group is selected to be biophobic; and

wherein the $HS(CH_2)_n$ portion of the first and second self-assembled monolayers are the same.

84. An article defining a surface; the surface comprising a plurality of isolated regions of a molecular species on the surface, the plurality of isolated regions defining a

pattern, the pattern corresponding to a pattern of a stamping surface able to direct formation of the pattern of the molecular species on the surface, wherein the molecular species exposes a first chemical functionality.

85. The article of claim 84, wherein the plurality of isolated regions comprise a self-assembled monolayer on the surface.

86. The article of claim 84, wherein the first chemical functionality selectively binds a species selected from the group consisting of proteins, antibodies, antigens and carbohydrates.

87. A device having a surface, comprising:

a layer of a molecular species, comprising a biological attachment agent, in a first, predetermined pattern, the layer being contiguous with a portion of the surface that is in a second, predetermined pattern, wherein the molecular species terminates in a functional group selected to bind to a particular material.

88. A biological device having a surface, comprising:

a plurality of spaced apart isolated regions of a molecular species over the surface in a predetermined pattern, wherein the molecular species of the isolated regions is a biological attachment agent that facilitates attachment of biomolecules while maintaining the function of the biomolecules.

89. The device of claim 88, wherein each isolated region is less than 10 microns.

90. The device of claim 89, wherein each isolated region is less than 5 microns.

91. The device of claim 90, wherein each isolated region is less than 0.1 microns.

92. The device of claim 88, wherein the isolated region of a molecular species in a predetermined pattern is surrounded by an inert background region.

93. A device comprising:

at least one isolated region of a molecular species over the surface in a predetermined pattern, wherein the molecular species of the isolated region is a protein attachment agent that facilitates attachment of at least one protein to the isolated region.

94. An array device comprising:

a surface; and one or more immobilization islands in a pattern over the surface and surrounded by a background region, the background region comprising a species forming a self-assembled monolayer and terminating in a functional group selected to bind to a particular material.

95. A device comprising:

a substrate having a surface material;

at least one isolated region over the surface, each isolated region comprising a molecular species comprising the structure R'-A-R", where R' is selected to bind to the surface material, A is a spacer and R" is a group that is exposed; the molecular species being a biological attachment agent.

96. The device of claim 95, wherein the at least one isolated region is surrounded by an inert background region.

97. A device for immobilizing at least one biological material in a specific and predetermined pattern comprising:

a surface;

an array of immobilization islands in a specific and predetermined pattern over the surface isolated from each other by at least one background region;

the pattern corresponding to a pattern of a stamping surface able to direct formation of the pattern of the immobilization islands on the surface;

the array of immobilization islands comprising a first self-assembled monolayer having an at least one first functional group and wherein the at least one first functional group is selected to be biophilic; and

the at least one background region comprising a second self-assembled monolayer

having a second functional group wherein the second functional group is selected to be biophobic.

98. A kit comprising:

an article constructed and arranged to transfer a self-assembled monolayer-forming molecular species to a substrate surface, comprising an applicator surface having at least one indentation formed therein and a protrusion pattern adjacent the at least one indentation, the article able to transfer a self-assembled monolayer-forming molecular species from the applicator surface to the substrate surface; and

a self-assembled monolayer-forming molecular species for application to the substrate surface by the article.

99. The kit as recited in claim 98, the article surface comprising at least one resolved feature providing stamping resolution of less than about 100 microns.

100. The kit as recited in claim 98, the article surface comprising at least one resolved feature providing stamping resolution of less than about 10 microns.

101. The kit as recited in claim 98, the article surface comprising at least one resolved feature providing stamping resolution of less than about 1 micron.

102. The kit as recited in claim 98, the article surface comprising at least one resolved feature providing stamping resolution of less than about 0.25 micron.

103. The kit as recited in claim 98, the article comprising an elastic material.

104. The kit as recited in claim 103, the elastic material comprising a hardenable fluid.

105. The kit as recited in claim 103, the elastic material selected from the group consisting of silicone polymers and copolymers, epoxy polymers and copolymers, and copolymers thereof.

106. The kit as recited in claim 98, the article comprising polydimethyl siloxane.

107. A kit as in claim 24, the applicator surface including a portion having a lateral dimension of less than about 1 micron.

108. A kit as in claim 24, the applicator surface including a portion having a lateral dimension of less than about 0.25 micron.

109. A kit as in claim 24, the applicator formed of an elastic material.

110. A kit as in claim 24, the applicator formed of an elastic material formed form a hardenable fluid.

111. The kit as in claim 110, the elastic material selected from the group consisting of silicone polymers and copolymers, epoxy polymers and copolymers, and copolymers thereof.

112. The kit as in claim 41, wherein the applicator surface includes a portion having a lateral dimension of less than about 0.25 micron.

113. A kit as in claim 41, the applicator surface including a portion having a lateral dimension of less than about 1 micron.

114. A kit as in claim 41, the applicator surface including a portion having a lateral dimension of less than about 0.25 micron.

115. A kit as in claim 41, the applicator formed of an elastic material.

116. A kit as in claim 41, the applicator formed of an elastic material formed form a hardenable fluid.